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is so, the biologist need not content himself with viewing the panorama of evolution respectfully from the distance of the ages; he can actually observe the process going on in his laboratory.

The next step is to induce mutations experimentally, but this has not yet been done. We know exactly what it is that changes, but we do not yet know how the change is brought about.

Although the mutation theory in the form first proposed by deVries was backed largely by evidence which he had obtained regarding sudden changes in the evening primrose, it now appears that the changes he observed were probably not alterations in the hereditary factors themselves, but consisted merely in the formation of new combinations of old factors, taking place in a peculiar way which has since been duplicated in *Drosophila* experiments. Nevertheless, the work on *Drosophila* places it beyond doubt that real changes in hereditary factors, or mutations, do occur, even though the so-called mutations in deVries's evening primrose are probably not valid examples of the process.

It is a curious fact that Mendel's original discovery, which laid the foundation for all the recent work in heredity, aroused no interest during his lifetime. Most biologists were then engaged in comparing the structures of organisms, in speculating on transitional forms, and seeking these intermediate forms among living or fossil animals and plants, or in their own imaginations. While this gave a plausible moving picture of the successive stages of evolution, it told us nothing of the mechanism which brought the stages about. Paradoxically enough, it was the turning away from the historical method that threw light on the method of biological history; for only with the shifting of the center of interest from the descriptive and historical to the mechanical and experimental mode of procedure was Mendel's discovery appreciated and a particulate theory of heredity developed. This theory has explained the mechanism of heredity and sex determination; it has all but solved the question of what evolutionary change is; and it has enabled the biologist to analyze the structure of living matter by a method which, like the astronomer's analysis of the constitution of the stars, is none the less precise because it does not treat the unknown with chemical reagents.

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Inbreeding and Outbreeding: Their Genetic and Sociological Significance. EDWARD M. EAST and DONALD F. JONES. Philadelphia and London: J. B. Lippincott & Company. 1919.

Whether close inbreeding causes deterioration of the race and cross-breeding re-invigorates it, is a question that has long been disputed. Darwin treated the subject at some length and gathered evidence both from the records of breeders and from his own experiments. But the problem could not be settled on the basis of the incomplete data and insufficient knowledge of heredity available in the past. It was not until the development of the Mendelian theory that a sufficiently powerful method of analyzing the problem was discovered. The book by Professor East and Dr. Jones gives an account of the solution of the problem by means of this theory.

It has been generally believed that inbreeding is accompanied by a deterioration of the race, and that when this occurs cross-breeding brings about renewed vigor. The older workers were inclined to attribute these results to the method of breeding itself; and the notion that close inbreeding is in some mysterious way harmful, is still widely prevalent.

The modern advances in heredity have, however, shown that it is not the inbreeding itself that is harmful. Inbreeding merely separates out of a complex population the different component strains. Each strain is purer, and hence more uniform, than the original mixture; but whether the result is good or bad depends on the nature of the hereditary factors which were present in the original population, for inbreeding merely sorts out what is already present. After this sorting out has taken place, that is, where a race is pure, inbreeding produces no change.

The matter is not, however, quite so simple, because it has been shown that certain hereditary factors fail to produce their effects in the presence of certain others. If there are potentially injurious factors thus lurking unseen in the original population, it is easy to understand how they may produce a bad effect when separated out. Conversely, the good effects of cross-breeding are due to each race's supplying factors which counteract the injurious factors of the other race; and only where one race supplies the good points which the other lacks does an improvement result.

The data which East and Jones have here brought together have a wide applicability to practical animal and plant breeding. The authors also attempt to apply them to the field of human heredity. It is obvious that if such a character as mental ability is due to a happy combination of hereditary factors, the falling apart of the combination through the distribution of the factors in the course of heredity will account for the comparative scarcity of genius. Such generalizations are of great value in pointing out the direction of further research. Undoubtedly the laws of heredity are theoretically as applicable to man as to any other animal. There are, however, two difficulties in the way of applying them practically. One is the lack of definite knowledge concerning the inheritance of specific human traits; the other is the lack of an objective standard of value. As East and Jones say, "Each sub-race believes implicitly in its own superiority and hopes for continued increase and ultimate survival. Perhaps such prejudice prevents any wholly objective discussion of the matter" (p. 248). While East and Jones are therefore quite correct in advocating research in human heredity, they are also entirely right in not claiming that the general theory of heredity has the same precision of application to specific cases in man as to cases in other organisms where a greater knowledge of details is available. East and Jones deserve all the more credit for calling attention to these difficulties because their own treatment of human heredity does not avoid the objections which they rightly raise against others.

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JOURNALS AND NEW BOOKS

PSYCHOLOGICAL REVIEW. November, 1919. *Emotion and Perception from the Behaviorist Standpoint* (pp. 409–427): GRACE A. DELAGUNA. – A discussion of the relation of emotion to perception is given. *Dark-Adaptation with Especial Reference to the Problem of Night-Flying* (pp. 428–453): PERCY W. COBB. – Fifteen subjects were tested. Several conclusions were drawn including "the limit of vision in dark-adaptation measured by the least brightness at which gross form may be recognized, is variable within extreme limits expressed by the ratio 7.4 to 1." *A Direct Deduction of the Constant Process Used in the Method of Right and Wrong Cases* (pp. 454–464): GODFREY H. THOMSON. – The object is to show the constant or Fechner-Müller-Urban process of calculating thresholds can be directly deduced from first principles. The historical development of the process is first traced and then contrasted with the direct deduction. The latter throws into clearer relief the nature of the assumptions and approximations made, and justifies Urban's, as against Müller's Table of Weights. *Time Relationships in the Formation of Associations* (pp. 465–473): H. A. CARR and A. S. FREEMAN. – Experimental data are presented from the field of animal psychology concerning two related problems: (1) The first question concerns the relative merit of simultaneous and successive presentation in relation to the speed of learning; (2) the second problem concerns the readiness with which a given temporal association will function in a backward as compared to the forward directions. The curve of learning for simultaneous presentation is one of positive acceleration. That for successive presentation approximates a straight line ascent with some indication of a slight negative acceleration. The